

SCENTED ANTHERS IN THE SOLANACEAE

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ABSTRACT

Anthers and corollas from fresh flowers of 27 taxa of Solanaceae were separately stored in jars and then smelled. The anthers nearly always produced scents, but the corollas often did not, and when present, the corolla scents were different from those of the anthers. We hypothesize that the anther scents are related to bee pollination and are a basal, conservative feature of the Solanaceae, while the corolla scents represent specializations to attract other pollinators.

Key Words: anthers, floral scents, pollination, Solanaceae, world-wide representatives

We have found that Solanaceous anthers emit scents that are different from those sometimes found in the corollas. The anther scents seem to be localized on pollen. The taxonomic distribution of the scents produced suggests that the anther scents may be conservative within the family.

Our sample (Table 1) of Solanaceae was of 27 taxa in 16 genera, including representatives from both major subfamilies and from several tribes. Anthers and corollas from several (usually 5-10) freshly opened flowers of different taxa were placed separately in new Baxter Snap-Cap specimen bottles¹ and stored for 2-8 hours to concentrate floral odors so they that could be detected by the human nose. In all attempts, odors were detected in the samples with longitudinally dehiscent anthers, and they were almost always different from scents found in corollas. When anthers of species with poricidal dehiscence were coarsely chopped with a razor blade to expose the interiors before storing in the specimen jars, they too emitted odors. There was only one exception: the pistillate flower of *Solanum polygamum*, which lacks pollen, yielded no detectable odor. The smelling of the jars was done by the authors and several others over a two-week period.

Some of the scents detected were of a "standard" nature and others were sweet. What we refer to as the "standard anther odor," found only in anthers, is difficult to characterize, but was thought

¹ Baxter Healthcare Corporation, Scientific Products Division, 1430 Waukegan Road, McGaw Park, IL 60085-6787.

Table 1. Anthers tried for smell test.

Taxon	Anther	Corolla	Notes
<i>Acnistus arborescens</i>	standard	none	
<i>Brugmansia 'rosea'</i>	standard	floral	weak
<i>Brunfelsia mire</i>	standard	floral	
<i>Brunfelsia pauciflora</i>	standard	floral	
<i>Brunfelsia undulata</i>	floral	floral	strong
<i>Capsicum annuum</i>	standard	none	slightly sweet
<i>Cestrum nocturnum</i>	standard	floral	weak
<i>Datura stramonium</i>	standard	floral	weak
<i>Iochroma cyaneum</i>	standard	none	
<i>Iochroma fuchsoides</i>	standard	none	
<i>Leucophysalis grandiflora</i>	weak	none	distinctive
# <i>Lycianthes</i> aff. <i>heteroclita</i>	weak	none	
<i>Nierembergia hippomanica</i>	standard	none	
<i>Petunia hybrida-1</i>	standard	none	
<i>Petunia hybrida-2</i>	standard	perfume	
<i>Physalis alkekengi</i>	standard	none	
<i>Salpichroa organifolia</i>	standard	none	
<i>Solanum americanum</i>	none	none	
# <i>Solanum americanum</i>	standard	none	weak
# <i>Solanum laciniatum</i>	perfume	none	
# <i>Solanum mahoriensis</i>	perfume	none	
# <i>Solanum polygamum</i>	none	none	
# <i>Solanum pyracanthos</i>	standard	none	slightly spicy
# <i>Solanum racemosum</i>	standard	none	
# <i>Solanum rudepannum</i>	fruity	none	
<i>Vassobia breviflora</i>	standard	none	sweet
<i>Witheringia correae</i>	standard	—	
<i>Witheringia solanacea</i>	standard	none	weak

Anthers coarsely chopped.

— Not assessed.

27 taxa of Solanaceae in 16 genera.

to be distinctive and not to resemble any floral or fruit fragrances or the "green" odors often associated with crushed foliage. The standard anther odor differed slightly in different taxa, but was always identifiable and similar. In many taxa, corollas yielded no odors, but those that did tended to have sweet scents resembling those of perfumery. Odors were not detected before the anthers opened, and they diminished in samples taken one or two days after flower opening.

Our sample, although limited, does include a taxonomic range that suggests that anther scents are general if not universal in the

family. Our sampling showed that many species have two scent systems, one in the anther and another in the corolla, each producing quite different scents.

This work substantiates earlier reports of scents in the anthers of angiosperms (Percival, 1965) and scented pollen in the Solanaceae (Buchmann, 1983). Our methodology in recording these scents is subjective but easily repeatable. Such subjectivity is commonly accepted in observations of colors, insect sounds, and textures of many objects. We hope that more precise methodology will later permit better description to facilitate further use and expanded inferences from these results and suggest the site and mechanisms of fragrance production. We think that the fragrances are related to pollination, as scents are well known to be pollinator attractants in flowering plants, and we assume that the small amounts of scent emitted by these anthers can be effective in attracting pollinators.

Fragrance, often night-timed, is well known in many Solanaceae, for example, *Cestrum nocturnum*, varieties of *Petunia hybrida*, cultivated species of *Nicotiana*, and some species of *Brunfelsia*. These strong fragrances are produced on the corolla (Table 1). In *Brunfelsia*, only the more advanced sections of the genus, which is normally butterfly or hawkmoth pollinated, have such corolla scents (Plowman, 1973, Ph.D. thesis, Harvard University). In contrast, some species of *Iochroma* (Table 1), which have tubular red or blue flowers and are presumably hummingbird-pollinated, lack corolla scents. It is interesting that all of these, *Cestrum*, the petunias, the nicotianas, the brunfelsias, and the iochromas, have anthers with what we term the standard scent. Only *Brunfelsia undulata* had a similar odor in both anthers and corolla.

Although the Solanaceae are pollinated in a variety of ways, poricidal species adapted to buzz pollination (Buchmann, 1983) comprise more than half the species in the family (D'Arcy, 1990), and many of the genera with longitudinal dehiscence are also visited by bees. Because the standard anther odor is present in a wide range of taxa, we suggest that it is related to bee pollination and we also suggest that it may be basal in the evolution of the family.

Solanum sect. *Leptostemonum* has a number of adaptations that may be looked upon as specializations, e.g., cauline and foliar spines, stellate hairs, and attenuate anthers with small pores. Some

members of this subgenus depart from the standard anther odor condition in having sweetly fragrant anthers, which may also be a specialization. It would be interesting to us to know whether the pollinators of *Solanum* sect. *Leptostemonum*, differ from the bee pollinators that visit flowers with the standard anther scent.

If the Solanaceae are primarily or ancestrally bee-pollinated, the development of scent, color, and shape innovations to attract new pollinators has generally not been accompanied by a reduction or disappearance of the anther scent system which may be basal in the family and involved in attraction of basic bee pollinators. Hence the standard anther scent system distributed across much of the family might be thought of as a conservative pollination attribute of members of the Solanaceae.

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